



Climate change in the past



The skull of *Iguanodon atherfieldensis*, found in Britain. The fossil evidence of dinosaurs and plants suggests that the Earth was several degrees warmer in the Cretaceous than it is today.

Over the last 4 billion years, the Earth's climate has changed many times.

Earth's unstable climate

Life on Earth has flourished and evolved for hundreds of millions of years. However, this does not mean that the climate has been stable throughout this time.

Geological data shows evidence of large-scale climate changes in the past, caused by factors like the tilt of the Earth's axis and tectonic plate movement (as climate is affected by the distribution of the planet's continents). Some of these changes were gradual; others were much more rapid.

Cretaceous world

In the mid Cretaceous, about 100 million years ago, the distribution of fossil plants, and large herbivorous dinosaurs, suggests sub-tropical conditions extended to Alaska and Antarctica and there were no polar ice caps. The planet was warmer than today - scientists have estimated it was 6 – 8°C warmer. Carbon dioxide levels in the atmosphere were about 5 times higher than today.

These warm conditions lasted for tens of million of years before the climate started cooling.

Rapid temperature change

The geological record also reveals dramatic events when there was much more rapid climate change. One of the fastest changes in Earth's temperature took place during an event that oceanographers call the **Palaeocene-Eocene thermal maximum**.

55 million years ago, global temperatures rose 6°C over a period of 20,000 years or less. Like climate change today, scientists think that an increase in greenhouse gases caused this rapid warming. This was possibly due to a catastrophic release of frozen methane deposits - like carbon dioxide, methane is a greenhouse gas.

This period of climate change caused major ecosystem changes and extinction of many organisms.

The ice ages

In the recent geological past, much of Britain was covered by ice sheets. We know this because the landscape shows many distinctive glacial landforms, especially in North Wales, Scotland and the Lake District. Also, fossils of mammoths and woolly rhinoceroses, which lived in cold climates, have been found across southern Britain.

This type of evidence, along with marine sediment cores and ice cores, shows that over the past 2 million years, climate fluctuated dramatically between ice ages and warm interglacial periods, similar to today's climate.

These major changes were driven by cyclical changes in the Earth's orbit, which altered the distribution of solar energy between the seasons and across the Earth.

An inescapable conclusion of this is that the Earth's climate is unstable and minor changes in the Earth's energy budget cause large changes in climate.

Will the planet survive human interference?

There is some comfort in the knowledge that even the worst-case models of future climate change are unlikely to result in the Earth experiencing climates warmer than those seen in the Cretaceous. So, we are unlikely to make the planet uninhabitable for life.

Unfortunately though, a rapid change to much warmer temperatures and higher sea levels would cause enormous disruption to ecosystems and human society across the world. Some future climate change is inevitable but anything we can do to reduce the scale of this change will be worthwhile.
